

## **SWIMMING POOL SERVICE TECHNICIAN'S STUDY GUIDE**

**LOS ANGELES COUNTY - DEPARTMENT OF PUBLIC HEALTH  
ENVIRONMENT HEALTH  
RECREATIONAL WATERS PROGRAM  
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**NOTES:** This study guide reflects only a portion of what is contained on the Swimming Pool Service Technician examination and should not be used as the sole source of preparation for the examination.

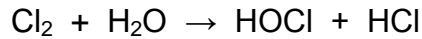
**When you are ready to take the examination, please call  
(626) 430-5360 for an appointment.**

## **Part I**

**Disinfection, Water Balance, Filters, Recirculation, Pumps, Maintenance,  
Miscellaneous, Math Problems, Formulas**

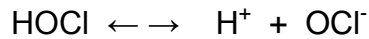
## DISINFECTION

The pH or acidity/alkalinity of pool water plays an important part in determining the effectiveness of chlorine products at disinfecting pool water. When chlorine is added to pool water, it results in formation hypochlorous acid, the major disinfecting agent of all chlorine compounds.



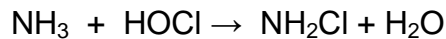
In the above equation, when chlorine gas is added to water it forms Hypochlorous Acid and Hydrochloric acid

Hypochlorous acid is measured as free available chlorine residual. Hydrochloric acid is a by-product and is not an effective disinfectant. Depending on the pH, Hypochlorous Acid dissociates into hydrogen ions and hypochlorite anions.



Hypochlorous acid will dissociate or breakdown into Hydrogen Ions and Hypochlorite Anions depending on the pH of the water. The lower the pH or more acidic, the more Hypochlorous Acid remains in the water and the more disinfection takes place. The higher the pH the less Hypochlorous Acid remains and the more Hydrogen Ions and Hypochlorite Ions exist. Hypochlorite Anions are a weak disinfectant.

Chlorine tends to combine with ammonia products and other nitrogen compounds in pool water to form chloramines which are measured as combined chlorine.



This equation shows ammonia combining with Hypochlorous Acid to form Monochloramine plus water. Further chemical reactions can form additional chloroamines such as Dichloramines and Nitrogen Trichloride. Monochloramines are the most prevalent type of chloramine in pool water. Combined chlorine is a weak disinfectant which imparts a strong chlorine odor and irritates the eyes. Combined chlorine forms more rapidly during heavy bather loads. The ideal level for combined chlorine is 0. When the combined chlorine level exceeds 0.2 - 0.5 parts per million (ppm), the pool should be superchlorinated or shocked. This is usually accomplished by increasing the chlorine residual to 5 - 10 parts per million. Doing so achieves breakpoint chlorination which is the process of adding sufficient free available chlorine to convert combined chlorine or chloramines to inert elements. The State Pool Code requires that the free available chlorine level in pool water be maintained at 1.0 ppm or above in pools not using stabilizer and 1.5 ppm in pools using stabilizer. The Health Department recommends maintaining chlorine residuals in swimming pools at 1.5 to 2.5 ppm and spas at 2 - 3 ppm. Pools that have been superchlorinated should not be used until the chlorine residual reduces to below 5 ppm.

Bromine in its elemental form is a reddish-brown liquid approximately three times heavier than water. It is extremely dangerous to handle. Safer forms of bromine have been developed such as Hydantoin bromine which come in sticks or tablets and can be

used in an erosion-type feeder. Bromine has several advantages over chlorine. Bromamines are excellent disinfectants and unlike chloramines do not produce an objectionable odor and eye irritation. Bromine is a more effective disinfectant across a wider pH range than chlorine. Bromine must be dispensed in a device called a brominator which operates similar to a erosion-type chlorinator. Bromine levels in swimming pools should be kept between 3.5 - 4.5 ppm and 4.5 to 5.5 ppm in spas. It's main disadvantage is it's high cost.

There are basically two chemicals which are commonly used to test for chlorine residual in pool water. The first is Orthotolidine. It's disadvantage is that unless performed under special conditions, it cannot accurately measure free and combined chlorine but instead indicates only total chlorine residual. Test kits using DPD (Diethyl-p-phenylenediamine) on the other hand, can measure both free and combined chlorine levels and are the only type that can be used at public pools. A common type of DPD test kit adds a number 1 tablet to a measured amount of pool water to obtain a free chlorine residual reading by comparing the color of the water to standard color blocks. A number 3 tablet is then added to obtain the total chlorine residual. The combined chlorine residual can be calculated by subtracting the free chlorine residual from the total chlorine residual. For example, if a pool has 3.0 ppm of total chlorine and 2.0 ppm free chlorine, the amount of combined chlorine will be 1.0 ppm. Water for the test should be taken between 12 to 18 inches below the surface of the water. Orthotolidine or DPD tablets should never be dropped directly into the water as the results will be inaccurate and introduction of the chemicals in the water could be hazardous to bathers. Water from tests should not be thrown back into the pool. Directions which come with the kit should be carefully followed.

Liquid chlorine or Sodium Hypochlorite ( $\text{NaOCl}$ ) has approximately 10 - 12% available chlorine and a pH of 13+. Regular use of liquid chlorine requires the addition of an acid product to control the pH. It takes approximately 8 ounces of acid to neutralize the caustic nature of one gallon of liquid chlorine. The advantages of using Sodium Hypochlorite is low cost, minimal danger in use and storage, and ease of mixing with pool water. The disadvantages are short shelf-life, increased levels of salt (sodium) in pool water, and possibility of scale formation if pH is not controlled.

Trichlorisocyanurates and Dichlorisocyanurates (Trichlor and Dichlor) are organic chlorine compounds which have chlorine molecules attached to a molecule of Cyanuric Acid. Both compounds are acidic, with Trichlor having a pH of 2 to 3 and Dichlor a pH of 6.8. Soda ash is usually added to raise the pH when these products are used. Trichlor has 90% available chlorine and Dichlor 60 - 65%.

Gas chlorine ( $\text{Cl}_2$ ) has 100% available chlorine. It is a light green gas which is  $2\frac{1}{2}$  times heavier than air. It is extremely toxic and can be used at public pools only under strict conditions specified in the State Pool Code, including a separate chlorination room with proper ventilation and approved equipment. Cylinders, both full and empty, should be secured to walls and stored in a separate chlorination room. Small leaks of chlorine gas can be detected with a 26 baume solution of ammonia which will produce a white smoke. Large leaks should be approached only with an approved self-contained breathing apparatus. When chlorine gas dissolves in water it imparts a extremely low pH. It is necessary to continually feed soda ash or caustic soda to maintain the pH in balance. The advantages of using gas chlorine are low cost, indefinite shelf-life, and its

ability to oxidize and disinfect. The disadvantages are the dangers of handling the product, initial cost and upkeep of equipment, and special on-going training required.

Calcium Hypochlorite (cal-hypo) ( $\text{CA}[\text{OCl}]_2$ ) is a dry and stable chlorine product with 65% available chlorine. The product is alkaline and requires addition of acid to balance pH. The disadvantages of using calcium hypochlorite is it increases calcium hardness in the pool and it must be pre-mixed before adding it to pool water

Lithium Hypochlorite ( $\text{LiOCl}$ ) is a dry and stable compound commercially available at 35% available chlorine and has an alkaline pH. It is often used to superchlorinate a pool. The disadvantages are high cost and relative short shelf-life at high temperatures.

Chlorine products are strong oxidizers. They should never be mixed with one another, with solvents or other chemicals. Mixing inorganic chlorine with any of the organic chlorine products will likely result a violent explosion. Mixing any type of acid with a chlorine product will result in the formation of chlorine gas. All containers, vessels, and vats containing chemical products should be properly labeled.

In order to prevent chlorine from dissipating from sunlight, Cyanuric Acid or stabilizer is used in pools. This product which is slightly acidic, bonds the chlorine molecule until it is needed to be released for disinfecting. The level of stabilizer should be maintained between 40 - 60 ppm in pool water. Levels below 25 ppm are ineffective, and higher than recommended levels are not cost effective. State law requires that the Cyanuric Acid be kept below 100 ppm at all time in public pools. It is best to add Cyanuric Acid through the skimmer. The filters should not be backwashed for several days since Cyanuric Acid dissolves very slowly. Cyanuric Acid is usually added or adjusted several times a year. Both Dichlor and Trichlor chlorine products contain over 50% Cyanuric Acid and will replace lost stabilizer which occurs when pools are refilled after splash-out. Frequent use of stabilized chlorine can lead to excessive levels of stabilizer. The only proper way to reduce high levels of stabilizer is to partially drain and refill the pool.

Automatic chlorinators are devices which dispense a small amount of chlorine into the recirculation system over a period of time, usually by pumping from a reservoir with a positive displacement type pump or through an erosion-type feeder. The reservoir type has either liquid chlorine or another diluted chlorine product in a 20 or 30 gallon reservoir. A positive displacement pump connected to a timer then pumps the liquid solution directly into the recirculation system. Erosion-type chlorinators are attached to the recirculation system at two points with different pressure levels. This causes recirculation water to flow into the chlorinator past chlorine tablets with slowly dissolve and introduces the chlorine product into the recirculation system. All public pools are required to have an automatic chlorinator. Floating type chlorinators or tablets placed in skimmers are not permitted in public pools. Chlorinators should be periodically taken apart and cleaned with dilute Muriatic Acid.

## WATER BALANCE

The pH of pool water is a measurement of its hydrogen ion content or acidity / alkalinity level. The pH range can extend from 0 to 14. At a pH of 7 the water is neutral and neither acidic or alkaline. As the pH is lowered towards 0, the water becomes more

acidic. As the pH is raised towards 14, the water becomes more basic or alkaline. A change in pH from 7 to 5 represents a 100 fold increase in hydrogen ion concentration or acidity. The pH of pool water should be kept between 7.4 and 7.6. The State Pool Code requires that the pH in a public pool be kept between 7.2 and 8.0. It is important to maintain the pH at proper ranges because the effectiveness of chlorine as a disinfectant is dependent on proper pH levels. The pH of pool water is normally measured using a chemical called Phenol Red, which has a indicator range of 6.8 to 8.0. A drop or two of Sodium Thiosulfate is added to the test before the Phenol Red to eliminate any residual chlorine which will interfere with the test. The dropper bottle should be held in a vertical position when dispensing the drops and the hand should not be used to cover the test vial when mixing as this may produce false readings. Various chemicals are used to adjust the pH which is affected by makeup water or the addition of chlorine products. Sodium Carbonate or Soda Ash ( $\text{Na}_2\text{CO}_3$ ) is used to raise the pH of pool water. It comes in a powdered form and is broadcast into the pool. Sodium Hydroxide or Caustic Soda ( $\text{NaOH}$ ) is a highly corrosive liquid which is used to raise the pH, usually in pools with large volumes of water and when chlorine gas is used. It is pumped into the recirculation system at a controlled rate using a positive displacement type pump. Sodium Bicarbonate or Baking Soda ( $\text{NaHCO}_3$ ) is used to raise the total alkalinity and not appreciably change the pH. Total alkalinity greatly influences where the pH will stabilize to after a pH adjusting chemical is used. It is a measure of the extent to which a given amount of water is buffered. Total alkalinity represents the amount of bicarbonate, carbonate and hydroxide alkalinity that is present. Their amounts depends on the pH of the pool. At the normal pH found in pool water most of the alkalinity is in the form of bicarbonate alkalinity. Total alkalinity should be maintained between 80 and 150 ppm in plaster pools and 125 - 175 ppm in non-plaster type pools.

Hydrochloric Acid or Muriatic Acid ( $\text{HCl}$ ), as well as Sodium Bisulfate or dry acid ( $\text{NaHSO}_4$ ), are used to lower the pH of pool water. No more than one-half quart of liquid acid per 10,000 gallons should be added at one time to a pool, otherwise damage to equipment may result. One hour should be allowed between half quart doses. Acid should be diluted in water and poured into the deep end of the pool and not into the skimmer or shallow end. When diluting acid, always pour the acid into the water not the reverse. One should never refill any empty chemical containers with a chemical other than the same chemical that originally came in the container. Excessive acid and low pH in pool water can lead to damaged equipment and can cause bluish-green staining of the plaster when copper is leached from the recirculation piping and heat exchanger. When pool water has been in an acidic state for an extended period of time, the water should be tested for copper. If level is over 0.2 ppm, the pool should be partially drained and refilled before adjusting the pH or else staining may result.

Total hardness is a measure of the amount of calcium, magnesium and other metal ions in water. When measuring hardness in pool water, one is measuring calcium hardness. The calcium hardness level in pool water should be kept between 175 and 300 ppm. Too high a calcium level may lead to the formation of calcium carbonate or scale, with rough plaster surfaces, clogged piping, reduced circulation, heater inefficiency, and eye irritation. Too low a level can result in the etching and pitting of plaster, and corrosive water. If the calcium level is too high, the pool should be partially drained and refilled. If the level is too low, Calcium Chloride should be added. Low calcium hardness is

usually not a problem on the west coast where make-up water is high in calcium hardness to begin with.

Another indication of water quality is the level of Total Dissolved Solids (TDS) in the water. TDS is an electrochemical measurement of a water's ability to conduct an electrical current. TDS is a measurement of only the charged particles in water. Neutral particles are not measured as TDS. TDS is generally used to indicate when it is necessary to drain a pool. Make-up water coming into a pool may vary in its TDS level. Generally, a swimming pool should be drained when the TDS is greater than 2,000 ppm over its starting TDS, and for a spa when the TDS is greater than 1,200 ppm over its starting TDS. High TDS can lead to algae growth despite adequate chlorine residuals, interference of disinfectants in killing pathogens, cloudy water despite good filtration and chlorination, false readings on chlorine tests, and eye and skin irritation.

The Saturation or Langelier Index is a test that indicates if pool water has scaling or etching properties. The factors used to calculate saturation index are pH, water temperature, alkalinity, and calcium hardness. A saturation index of 0 indicates the water is balanced. A negative number greater than -0.5 indicates the water is etching and can be corrosive to metals in the pool and etch the pool plaster. A number greater than +0.5 indicates the water is scaling and can form calcium deposits which clog recirculation pipes and filter grids, and can stain pool plaster. In calculating the Saturation Index, factor values of water temperature, alkalinity and calcium hardness are obtained from a Saturation Index table. These factors are added to the actual pH reading and the value of 12.1 is subtracted from this total. The result is the Saturation Index. (Saturation Index = pH + temperature factor + calcium hardness factor + total alkalinity factor - 12.1).

## FILTERS

DIATOMACEOUS EARTH (DE) - Diatomaceous earth filters are the most common type of filters used on pools in Southern California. They consist of a plastic frame covered with a cloth element. Diatomaceous earth is made up of the fossil remains of tiny aquatic plants called diatoms. Diatomaceous earth, when added to the pool filter, coats the cloth filter elements. It is the DE that traps the dirt and does the filtering not the cloth elements. A DE filter should never be run without diatomaceous earth or dirt will clog the cloth elements. If this should happen, the elements should be scrubbed with a non-foaming detergent. The usual amount of earth added to a DE filter is about one half pound per 5 sq.ft. of filter area. A one pound coffee can filled with DE is equal to approximately one half pound of DE. The filter area of filters is measured in square feet. The larger the filter area, the longer the filter can run without requiring backwashing. Pumps should be sized so that they do not force too great an amount of water through the filter but at the same time be large enough to backwash the filter properly. An influent pressure gauge is required before the filter and a vacuum gauge is required before the pump on public pool recirculation systems. Using these two gauges the total dynamic head can be calculated. Starting pressures on clean filters will vary with different systems. When the pressure reading indicates that the pressure has increased approximately 10 psi over the starting pressure, it is time to backwash the filter. This is accomplished by reversing the flow of water through the filter usually with a combination of valves or a multiport valve, and flushing the DE along with accumulated dirt to waste. Waste water should be directed to a sanitary sewer or when

required, to a separation tank and then to a sanitary sewer or other approved disposal system. From time to time, the filter will have to be taken apart for a more thorough cleaning. Oils and grease can be removed from filter elements with a non-foaming type detergent. Scale can be removed by using diluted Muriatic Acid. DE filters are sized at 2 gallons per minute per square foot. This means that a 60 sq. ft. filter can have a maximum of 120 gallons per minute flowing through it. DE filters do the best job of filtering pool water.

**RAPID SAND AND HIGH RATE SAND** - These type of filters use varying grades of sand to do their filtering. As water passes through the layers of sand impurities are removed. Most of this is done on the surface of the sand. Like DE filters, when they are dirty, water is flushed backwards through the sand bed to waste. Rapid sand filters are used on large municipal pools and are much larger than high rate sand filters. The flow through high rate sand filters is much faster than rapid sand filters and consequently they are much smaller in size. Rapid sand filters are sized at 3 gallons per minute per square foot and high rate sand filter at 15-20 gallons per minute per square foot. Although not as good as DE filters, sand filters do a fairly good job of filtering pool water.

**CARTRIDGE** - Cartridge filters are made of a pleated cloth element. Dirt is trapped on the elements as the water is forced through the filter. When dirty, cartridge filters are taken out of the filter holder and hosed down, scrubbed, and disinfected in a chlorine solution. They should be allowed to completely dry before being put back into service. Cartridge filters have the disadvantage of being required to be taken apart each time the filter needs cleaning. Cartridge filters are sized at 0.375 gallons per minute per square foot. Cartridge filters do the poorest job of filtering pool water.

### RECIRCULATION

The recirculation system of a pool consists of a main drain and skimmer or in larger pools an overflow gutter and surge chamber. The water is then drawn to a centrifugal pump which forces the water through a filter and a heater and then back to the pool through numerous return lines. The amount of water being filtered or the flow rate, is expressed in gallons per minute (gpm) and the length of time it takes to filter a volume of water equivalent to the volume of water in the pool is called the turnover rate. The minimum required turnover rate for a public swimming pool is 6 hours. Public spas must have a minimum turnover rate of one half hour and public wading pools must have a minimum turnover rate of 1 hour. As an example, in order to calculate the flow rate required for a 36,000 gallon swimming pool, you would divide 36,000 by 6 hrs. and 60 minutes or  $36,000 / (60 \times 6)$  which would equal 100 gallons per minute. If a 36,000 gallon pool had a flow rate of 100 gpm, it would have a turnover rate of 6 hours or  $(36,000 / (100 \times 60))$ . Pumps, filters, and all related parts of a public pool recirculation system must be kept in operation whenever the pool or spa is available for use and as long as necessary to maintain the water in a clean and clear condition. This usually requires 20 - 24 hours a day for a public pool. A pool should never be used if the water becomes so cloudy that the main drain is not clearly visible from any portion of the deck. A public pool will be posted closed by the Health Department when the main drain is not clearly visible. It cannot be reopened until the water is clean and clear and only with written permission after all other violations are corrected. Unless the recirculation

system is continually on, time clocks for the pool recirculation system and lights should be properly set.

The weir/flapper or donut ring type of weir on a skimmer is necessary to provide proper skimming of the surface of the water. Without a weir, skimming will not take place. In addition, there is an anti-air lock device which will prevent air from entering the suction line if the water level drops below the skimmer opening. Skimmer baskets should be cleaned on a regular basis and replaced when broken. When a skimmer is not connected to a main drain, it is required to have an equalizer line located below the skimmer opening. This prevents air from entering the suction line if the water level gets too low. Skimmers with an equalizer line should have a equalizer valve installed inside the skimmer on the equalizer line. This valve opens only when the water level is low and otherwise remains closed allowing full skimming. Perimeter overflow or rimflow skimming systems are usually used on larger pools and flow to a surge chamber. The surge chamber is used to balance the level of water in the pool and maintain skimming when large numbers of people enter the pool.

A flowmeter is a device which indicates the rate of flow in gallons per minute of a recirculation system. Flowmeters are required on all public pools. On small pools, they are usually plastic tubes with an indicator weight, while on large pools they may be mechanical with a gauge resembling a rpm meter on a car. They are usually placed after the filter to prevent clogging and should be located far enough away from heaters to prevent warping.

A sight glass is used to observe the backwash water when backwashing the filter. When the water is clear the backwashing is complete. Frequently a sight glass is not needed because backwash water can be observed at the air gap between the backwash line and p-trap.

## PUMPS

The most common type of recirculation pump used on pools is the centrifugal pump. The "feet of head" in a recirculating system is the measurement of the pressure resisting the flow of water caused by pipes and equipment through which water flows. Pumps are rated in horsepower and are sized using pump curves. A pump curve is a curve showing the various flow rates at different "feet of head". The higher the "feet of head" the less the flow of water. The shut-off head is the "feet of head" at which there is no flow. The "feet of head" in a recirculation system can be measured by placing a vacuum gauge on the suction side of the pump and a pressure gauge on the discharge side, converting to feet of head to pound per square inch and adding the readings together. If a pump is operated with a lack of water being supplied on the suction side, cavitation occurs. Cavitation can be identified by a rumbling noise, erratic pressure gauge and flowmeter readings, and air bubbles on the discharge side. Cavitation will cause pitting of the impeller and eventually destroy the pump. The hair/lint strainer basket should be periodically checked and cleared of any debris. The most common area for suction leaks to occur are at the O ring located on the pot cover. The O ring should be replaced if worn or leaking.

## MAINTENANCE

Public pools should have their chemical levels checked daily and should be serviced one to three times a week depending on the bather load. Heavily used public pools, such as at a health clubs, should have their chemical levels checked every hour and be serviced daily. Pool logs must be maintained on large or heavily used public pools and kept on file for a period of at least one year.

All public and private pools in Los Angeles County must be serviced by a certified Swimming Pool Service Technician or Apprentice. An apprentice must be employed by and work under the direct supervision of a certified Swimming Pool Service Technician. Persons with accounts delinquent for more than two years will be decertified.

Oils and scum should be removed from tile each time the pool is serviced. Broken or illegible depth marker tiles should be replaced promptly. Loose ladder/stair handrails/grab rails should be repaired or replaced promptly. Broken or missing skimmer lids or deck valve lids should be replaced promptly.

Missing or broken main drain covers must be replaced immediately. The pool must be closed until repairs are made. Covers requiring tools for removal are the only type allowed on public pools. A serious drowning hazard exists on suction outlets with missing, loose or broken drain covers.

Compressed gas chlorine cannot be used on public pools unless it is permanently installed on site, contained in a separate room, and dispensed through an approved chlorinator. "Gas shooting" from a portable unit is not allowed at public pools.

The following minimum safety equipment is required at all public pools:

- a. A body hook on a 12 ft. pole and a life ring with a rope as long as the widest part of the pool.
- b. An illustrated artificial respiration and CPR sign,
- c. An emergency sign with 911, address of the pool and address of the closest emergency services.
- d. A maximum occupancy sign for each pool and spa.
- e. Unless a lifeguard is provided a "No Lifeguard On Duty" sign.
- f. Keep gate closed signs
- g. At spas, a spa warning sign.
- h. A spa emergency shut-off switch sign if the spa has one.
- i. At pools with a maximum depth of 6 feet or less, a "No Diving" sign.
- j. A diarrhea warning sign.

Algae growth in pools is usually an indication that chlorine residuals are not being continuously maintained. Algae growth is stimulated by hot weather, sunlight, heavy bather loads, insufficient disinfectant, high TDS, rough finishes, and scale formation. Besides being aesthetically undesirable, the slipperiness of algae and its ability to cloud the water makes it a potential safety hazard. Algae also creates a tremendous disinfectant demand. A major part of eliminating algae growth in pools can be accomplished by brushing the walls and floor with a nylon or stainless steel brush. Algistats are products that inhibit the growth of algae while algicides are products which kill algae. Copper compounds are excellent algicides. When copper is added as an algicide it should be chelated to prevent staining of the pool walls and floor. Quaternary

ammonium compounds are also used as algicides but can lead to foaming of water. There are many other types of algicides that can be used.

## MISCELLANEOUS

When public pools are drained, replastered or renovated, the pool must be updated to the latest pool code requirements. If missing, handrails at stairs should be replaced. A marking line should be installed across the floor of the pool where the water depth is 4½ ft. Broken or worn depth markers should be replaced and markers should be checked for accuracy. Public pools should be replastered in a white color only. Spas may have a light color with a minimum Light Reflectance Value of 55%. All changes in equipment, the recirculation system or pool shell requires a pool plan check and must be approved by this Department and when applicable the Building Department.

Underwater pool lights at public pools should be on during nighttime hours unless the pool is enclosed by a separate fence or enclosure. Pool lights must always be on during nighttime hours when the pool is officially open for use. Pool hours must be posted at pool side.

A number of potentially serious illnesses such as ear, nose and throat infections, respiratory, urinary, and skin infections can be transmitted through improperly maintained pools and spas. It is important to always maintain pH and disinfectants at proper levels.

Make-up water for a pool must be from a potable source. The fill line must have the proper type of backflow protection. Backflow protection prevents the water from the pool from being drawn back into the public water supply. An over the rim fill line is air gaped and does not require any backflow device. The air gap must be a minimum of 2 pipe diameters or one inch, whichever is greater. For a fill line terminating in the tile line on the pool wall, the fill line be protected by an atmospheric vacuum breaker installed a minimum of 6 inches above the flood rim of the pool. This type of installation has no downstream valving and no pressure on the line. For devices such as auto fills, a pressure vacuum breaker must be used since the float valve constitutes downstream valving. The device must be installed a minimum of 12 inches above the flood rim of the pool and cannot be connected to any line under pressure. For fill lines directly connected to the recirculation system and under pressure, a reduced pressure principle backflow device must be used.

A flocculent or coagulant is a chemical product which is added to pool water to combine small particle of dirt into larger ones so that the particles can be easily filtered out. Alum or Aluminum Sulfate is used for this purpose with rapid sand filters. With proper pH and alkalinity the alum will form a gelatinous floc which will stick to the sand. Particles will then become trapped in the floc.

Sequesterants are products that are added to pool water to hold minerals and metals in solution and prevent staining of the pool walls and floor.

## MATH PROBLEMS

The following math problems may be on the examination. Know how to calculate:

The volume of swimming pools and spa pools.

Water loss in gallons given a drop in water level.

Required turnover for pools and spas.

Required filter flow rates for pools.

Required filter sizes.

Area of filter grids.

Total dynamic head of a recirculation system.

Horsepower of pool motors given voltage and amperage.

Chlorine residual, given a specific type of chlorine product, and the volume of a pool.

Required dosage of chlorine to reach breakpoint chlorination.

Dosage of a chlorine product necessary to "burn off" a specific chloramine level.

Dosage of neutralizer needed to eliminate excessive chlorine levels.

Dosage of soda ash needed to raise pH or acid to lower pH.

Dosage of Cyanuric Acid needed to raise to a specific level.

Saturation index.

Required surge capacity.

Combined chlorine given total chlorine and free chlorine residuals.

## FORMULAS

Volume of rectangle pool = length x width x average depth x 7.5

Volume of circular pool = radius x radius x 3.14 x average depth x 7.5

Required flowrate =  $\frac{\text{Pool Volume}}{\text{Turnover rate} \times 60}$

Required filter area =  $\frac{\text{Flowrate}}{\text{GPM per Sq.Ft.}}$

Turnover rate =  $\frac{\text{Gallonage}}{\text{Flowrate} \times 60}$

Water loss = Length x Width x (Loss in inches/12) x # of days x 7.5

Maximum bather load (pool) =  $\frac{\text{Surface area in Sq.Ft.}}{20}$

Maximum bather load (spa) =  $\frac{\text{Surface Area in Sq.Ft.}}{10}$

Total Chlorine = Combined Chlorine + Free Chlorine

Chlorine Residual

$$\text{in ppm} = \frac{(\text{pounds of product}) \times (\% \text{ strength}) \times (1,000,000)}{\text{volume} \times 8.3}$$

Power(watts) = Volts x Amps

$$\text{Required Cyanuric Acid} = \frac{\text{ppm desired} \times .083 \times \text{volume}}{10,000}$$

- One gallon of water weighs 8.3 lbs.
- One gallon of liquid chlorine weighs 10.0 lbs.
- One pound per square inch equals 2.31 ft. of water.
- One inch of mercury equals 1.13 ft. of water.
- One cubic foot equals 7.5 gallons.
- One horsepower equals 746 watts.
- 2 ounces of Muriatic Acid lowers the Total Alkalinity of 1,000 gallons of pool water 10 ppm.
- 0.083 lbs. of Cyanuric Acid raises the CYA level of 1,000 gallons of pool water 10 ppm.
- 0.15 lbs. of Sodium Bicarbonate raises the Total Alkalinity of 1,000 gallons of pool water 10 ppm.
- Area =  $\pi r$

## **Part II**

### **California State Pool Code**

The following are selections from the California State Pool Code that should be reviewed by Technician applicants.

## California Health and Safety Code

### **116038 Filing copy of plans prior to construction of public swimming pool.**

Every person proposing to construct a public swimming pool shall file a copy of the plans there for, prior to construction, with the local health officer having jurisdiction for approval.

### **116040 Operation and maintenance in sanitary, healthful and safe manner.**

Every person operating or maintaining a public swimming pool must do so in a sanitary, healthful and safe manner.

### **116043 Sanitary, healthful and safe condition of pool, appurtenances. etc.**

Every public swimming pool, including swimming pool structure, appurtenances, operation, source of water supply, amount and quality of water recirculated and in the pool, method of water purification, lifesaving apparatus, measures to insure safety of bathers, and measures to insure personal cleanliness of bathers shall be such that the public swimming pool is at all times sanitary, healthful and safe.

### **116045 Necessity of lifeguard service.**

(a) Lifeguard service shall be provided for any public swimming pool which is of wholly artificial construction and for the use of which a direct fee is charged. For all other public swimming pools, lifeguard service shall be provided or signs shall be erected clearly indicating that such service is not provided.

(b) "Direct fee," as used in this section, means a separately stated fee or charge for the use of a public swimming pool to the exclusion of any other service, facility, or amenity.

### **116060 Public nuisance.**

Any public swimming pool constructed, operated, or maintained contrary to the provisions of this article is a public nuisance, dangerous to health.

### **116065 Violation; misdemeanor; penalty.**

Every person who violates any provision of this article, building standards published in the State Building Standards Code relating to swimming pools, or the rules and regulations adopted pursuant to the provisions of this article, is guilty of a misdemeanor, punishable by a fine of not less than fifty dollars (\$50) nor more than one thousand dollars (\$1000), or by imprisonment for not more than six months, or both.

### **116068 Separate offense for each day.**

Each day that a violation of this article continues is a separate offense.

**California Code of Regulations  
Title 22, Chapter 20  
Public Swimming Pools**

Article 1. Definitions and Scope

**Article 3. Maintenance and Operation**

**65521 Pool Supervision Responsibility.**

- (a) Every pool shall be under the supervision of a person who is fully capable of, and shall assume responsibility for, compliance with all requirements relating to pool operation, maintenance and safety of bathers.
- (b) No pools shall be used or available for use unless all of the requirements of subsection (a) and the following are complied with.
  - (1) Routine (e.g., daily and weekly) operating procedures shall be permanently posted in a location accessible to and frequented by the operator.
  - (2) Manufacturers' instructions for operation and maintenance of mechanical and electrical equipment shall be kept available for the operator.

**65523 Operation Records.**

- (a) The operator of each pool open for use shall keep a daily record of information regarding operation, including readings of disinfectant residual, pH and maintenance procedures such as cleaning of filters and quantity of chemicals used.
- (b) If cyanuric acid by itself or in a combined form with the disinfectant is added to a pool, the cyanuric acid concentration shall be measured a minimum of once per month and records shall be kept of the results of such testing
- (c) Data collected pursuant to subsections (a) and (b) shall be maintained at least one year for inspection by the enforcing agent, or shall be submitted to the enforcing agent upon his request.

**65525 Recirculation and Purification System Operation.**

The pumps, filters, disinfectant and chemical feeders, flow indicators, gauges and all related parts of the pool water purification system shall be kept in operation whenever the pool is available for use, and at such additional times and periods as may be necessary to maintain the water in the pool in a clear and disinfected condition. The variation in flow during a filtration cycle shall be such as to not reduce the flow below 65 percent of the rate required in Section 3124B of Title 24, California Administrative Code.

**65527 Clarity of Water.**

The recirculation and purification system shall be operated and maintained so as to keep the pool water clean and clear. Under no circumstances shall the pool be used if the main drain is not clearly visible from the deck. Such a pool shall be closed and shall not be reopened until the water is clean and clear, and upon specific written approval of the enforcing agent. If the pool drain is still not visible 48 hours following inspection and closure by the enforcing agent, the enforcing agent may order the pool drained as a safety precaution.

**65529 Disinfection, pH Control and Cyanuric Acid.**

(a) Pools, when open or in use, shall be disinfected continuously by a chemical which imparts a residual effect and shall be maintained in an alkaline condition at a pH between 7.2 and 8.0. For pools using hypochlorite or gaseous chlorine without a stabilizer, a free chlorine residual at least 1.0 ppm shall be maintained throughout the pool. If cyanuric acid or a chlorinated isocyanurate is used, a free chlorine residual of at least 1.5 ppm shall be maintained throughout the pool. The cyanuric acid concentration in any pool shall not exceed 100 ppm. Appropriate test kits for measuring the pH, concentration of the disinfectant, and, when used, concentration of cyanuric acid shall be provided at each pool. If halogens other than chlorine are used, residuals of equivalent strength shall be maintained. A test kit for measuring the concentration of the disinfectant accurate to within 0.1 ppm shall be available at each pool.

(b) When test kits for chlorine utilize comparative color standards, the standards shall be accurate to within plus or minus 0.1 ppm. There shall be at least four color standards as follows: 0.6, 1.0, 1.5 and 2.0. The test kit shall be capable of testing for free chlorine residual.

(c) The enforcing agent may accept other disinfecting materials or methods after they have been demonstrated to provide a readily measurable residual. Such materials or methods must be as effective as the required chlorine concentration and must not be dangerous to public health or create objectionable physiological effects.

#### **65531 Bacteriological and Chemical Quality of Pool Water.**

(a) Bacteriological quality of water in the pool shall be such that not more than two consecutive samples, taken when the pool is in use, shall:

(1) Contain more than 200 bacteria per millimeter, as determined by the standard (35°C) plate count; or

(2) Contain a total coliform organism MPN (most probable number) count of 2.2 or greater per 100 milliliters of sample.

(b) Chemical quality of water in the pool shall not cause irritation of eyes or skin of the bathers, or have other objectionable physiological effects on bathers.

#### **65533 Cleanliness of Pool.**

(a) Floating scum, sputum or debris shall not be allowed to accumulate in the pool.

Skimmers, where provided, and water levels shall be maintained and operated to remove such material continuously. The bottom and sides of the pool shall be cleaned as often as necessary to be kept in a clean condition. The sides and bottom of pools, decks and other surfaces shall be kept free of slime and algae.

(b) Animals shall not be permitted in the pool or pool area.

#### **65535 Cleaning and Maintenance.**

(a) All parts of the pool and related pool facilities and equipment shall be maintained in good repair. Floors shall be kept free from cracks and other defects and in compliance with Section 3115B, Title 24, California Administrative Code. Walls, ceilings, partitions, doors, lockers and similar surfaces and equipment shall be refinished in a manner acceptable to the enforcing agent as often as necessary to be kept in a state of good repair.

(b) Hoses shall be provided for regular flushing and cleaning. The whole pool area shall be kept clean, sanitary and free of litter and vermin.

(c) Toilets, urinals, showers, wash basins and other plumbing fixtures shall be maintained in a clean condition, and in good repair.

#### **65539 Lifesaving, First Aid and Control of Bathers.**

- (a) Lifeguard services shall be provided in accordance with Sections 116028 and 116045 of the Health and Safety Code.
- (b) Where lifeguard service is provided, the number of lifeguards shall be adequate to maintain continuous surveillance over the bathers.
- (c) Where no lifeguard service is provided, a warning sign shall be placed in plain view and shall state "Warning-No Lifeguard on Duty" with clearly legible letters at least 10.2 centimeters (4 inches) high. In addition, the sign shall also state "Children Under the Age of 14 Should Not Use Pool Without An Adult In Attendance".
- (d) The enforcing agent may require posting of notices directing the bathers to make use of the toilets and showers before entering the pool. At all pools, diagrammatic illustrations of artificial respiration procedures shall be posted where clearly visible from the nearby deck. Such illustrations shall be protected against the elements. Also, the telephone number of the nearest ambulance, fire and police or sheriff's department shall be kept similarly posted along with instructions that, if needed, manual or mouth-to-mouth artificial respiration should be started immediately and continued until a physician arrives or mechanical resuscitators are applied.
- (e) Every swimming pool shall be equipped for safety and rescue purposes with one or more rescue poles not less than 3.6 meters (12 feet) in length with body hooks, and one or more life rings having a minimum exterior diameter of 43 centimeters (17 inches) readily accessible for use. Such life rings shall have attached to them an 0.476 centimeter ( $\frac{3}{16}$ -inch) line long enough to span the maximum width of the pool. The line shall be stored when not in use in such a way as to prevent kinking or fouling. When rescue can be effected from the perimeter of a spa pool, such a pool may be exempt from the requirements of this paragraph if so approved by the enforcing agent
- (f) When, in the opinion of the enforcing agent, any pool is of such size that unaided swimming by lifeguards may not offer sufficient protection to swimmers, one or more square-sterned boats equipped with oars, oarlocks and life rings, or paddle boats, as the enforcing agent shall order, shall be provided.
- (g) A first aid kit shall be provided at all swimming pools when required by the enforcing agent.

#### **65541 Health of Employees and Patrons.**

- (a) No person having a communicable disease shall be employed at a public swimming pool.
- (b) All patrons known to be, or suspected by the enforcing agent or the management of being afflicted with an infectious disease, suffering from a cough, cold or sores, or wearing bands or bandages shall be excluded from all public bathing places unless at least one of the following conditions is met:
  - (1) The patron submits a current written statement, signed by a licensed physician, confirming that the patron does not present a health hazard to other pool users.
  - (2) Pool use by the patron is approved by the enforcing agent.

#### **65545 Pool Closure.**

- (a) If, in the opinion of the enforcing agent, a pool is maintained or operated in a manner which creates an unhealthful, unsafe, or unsanitary condition, the pool may be closed by the enforcing agent. Such a pool shall not be reopened until correction is made, and upon, specific written approval of the enforcing agent.
- (b) Unhealthful, unsafe or unsanitary conditions include, but are not limited to, the failure to meet clarity, disinfection, pH, safety or bacteriological standards.

**65551. Shower, Toilet and Dressing Facilities.**

- (a) For shower, toilet and dressing facilities, the walls, partitions, doors, lockers and similar surfaces which require periodic cleaning shall be maintained smooth and finished so as to facilitate cleaning.
- (b) Showers shall be provided with soap in soap dispensers or containers.
- (c) For toilet facilities, handwashing detergent or soap, sanitary towels or hot air blowers, and toilet tissues shall be provided in permanently installed dispensing devices.

# California Code of Regulations

## Title 22, Chapter 31B

### Public Pools

#### Division I—GENERAL

##### SECTION 3101B

##### SCOPE

The provisions of this chapter shall apply to the construction, installation, renovation, alteration, addition, relocation, replacement or use of any public pool and to its ancillary facilities, mechanical equipment and related piping. Public pools include those located in or designated as the following: commercial building, hotel, motel, resort, recreational vehicle or mobile home park, campground, apartment house, condominium, townhouse, homeowner association, club, community building or area, public or private school, health club or establishment, water park, swim school, medical facility, bed and breakfast, licensed day-care facility, recreation and park district, and municipal pools.

##### SECTION 3102B

##### DEFINITIONS

**ANCILLARY FACILITY** is any area used in conjunction with or for the operation of a pool such as public dressing rooms, lockers, shower or bathroom areas, drinking fountains, equipment room, pool deck area, pool enclosure or building space that is intended to be used by pool users.

**BACKWASH** is the process of reversing the flow of water through the filter to thoroughly clean the filter media and/or elements and remove the debris from the contents of the filter vessel.

**CANTILEVERED DECKING** is the part of the deck which extends over a top edge of a pool or spa.

**CLEAN POOL WATER** is pool water that is free of dirt, oils, scum, algae, floating materials or visible organic and inorganic materials that would pollute the water.

**CLEAR POOLWATER** is pool water that is free from cloudiness and is transparent.

**COPING** is a slip-resistant cap installed on the top edge of a pool or spa.

**CORROSION RESISTANT** is capable of maintaining original surface characteristics under the prolonged influence of the use environment.

**DECK** is an area surrounding a pool which is specifically constructed or installed for use by pool users.

**DIATOMACEOUS EARTH** is a filtering media consisting of microscopic fossilized skeletons of diatoms.

**EASILY CLEANABLE** is a characteristic of a surface or material that allows removal of dirt, stains or residue by normal cleaning methods.

**EFFECTIVE PARTICLE SIZE** is the theoretical size of sieve in mm that will pass 10 percent by weight of sand.

**ENFORCING AGENT** is the health officer, director of environmental health, registered environmental health specialist or environmental health specialist trainee.

**EQUIPMENT AREA** is an area where the recirculation system and all related appurtenances are located.

**HANDHOLD** is a structure located at or above the water line around the perimeter of the pool wall that allows a pool user to hold onto the poolside for support.

**INLET** is a fitting or fixture through which recirculated water enters the pool.

**LADDER** is a series of vertically separate treads or rungs either connected by vertical rail members or independently fastened to an adjacent vertical pool wall.

**LIVING UNIT** is any building or portion thereof that contains living facilities including provisions for sleeping.

**MAIN DRAIN** is a submerged suction outlet typically located at the bottom of a pool that conducts water to a recirculating pump.

**MEDICAL POOL** is a special-purpose pool used by a State-recognized medical institution engaged in the healing arts under the direct supervision of licensed medical personnel for treatment of the infirm.

**OUTLET** is a fitting or fixture through which recirculated water is removed from the pool which may or may not be connected to the pump.

**PERFORMANCE STANDARD** is a standard that is accredited and published. Products compliant with a standard may be listed by any authorized nationally recognized testing laboratory.

**PERIMETER OVERFLOW SYSTEM** is a system which includes perimeter-type overflow gutters, surge basin or similar surface water collective system components and their interconnecting piping.

**PERMISSIBLE EXPOSURE LIMIT** is the maximum amount or concentration of a chemical that a worker may be exposed to under United States Occupational Safety and Health Administration regulations.

**POOL OR PUBLIC POOL** is an artificial basin, chamber or tank constructed or prefabricated with impermeable surfaces that is used, or intended to be used, for public swimming, diving or recreational activities but does not include individual therapeutic tubs or baths where the main purpose is the cleaning of the body. Any manmade lake or swimming lagoon with a sand beach or sand bottom is not a public pool.

**POOL OPERATOR or OPERATOR** is a person who is responsible for maintaining compliance with all requirements relating to pool operation, maintenance and safety of pool users.

**RADIUS OF CURVATURE** is the radius arc which denotes the curved surface from the point of departure from the springline of the pool to the pool bottom.

**READILY ACCESSIBLE** is capable of being reached easily for cleaning, repair, replacement or inspection without the necessity of removing a panel, door or similar obstruction and without requiring a person to climb over or remove obstacles or to use devices such as portable ladders.

**READILY DISASSEMBLED** means capable of being taken apart by hand or by using only simple tools such as a screwdriver, pliers or open-end wrench.

**RECESSED STEPS** are a series of vertically spaced cavities in the pool wall creating riser and tread areas for pool ingress and egress.

**RECIRCULATION SYSTEM** is the system of hydraulic components designed to remove, filter, disinfect and return water to the pool.

**RIMFLOWGUTTER** is a perimeter overflow system in which the overflow rim is at the same elevation with the deck.

**SKIMMEREQUALIZER LINE** is a submerged suction outlet located below the waterline and connected to the body of a skimmer that prevents air from being drawn into the pump if the water level drops below the skimmer weir or the skimmer is blocked by debris. A skimmer equalizer line is not a main drain.

**SLIP RESISTANT** is a rough finish that is not abrasive to the bare foot.

**SPA POOL OR SPA** is a pool that incorporates a water jet system, an aeration system or a combination of the two systems used in conjunction with heated water.

**SPECIAL PURPOSE POOL** is a pool constructed exclusively for a specific purpose, such as instruction, diving, competition or medical treatment.

**SPLASH ZONE** is the maximum distance the water from a spray ground can project horizontally.

**SPRAY GROUND** is a pool with no standing water in the splash zone and consists of a surge basin with a recirculation system from which water is directed through water features for contact with pool users.

**SPRINGLINE** is the point from which the pool wall breaks from vertical and begins its arc in the radius of curvature.

**STAIRS** are a series of two or more steps.

**STEP** is a riser and tread.

**SUCTION OUTLET** is any outlet that is connected to the pump through which water is removed from the pool.

**SURGE BASIN** is a reservoir or surge trench open to the atmosphere that receives water via gravity flow from the main drain, spray ground or perimeter overflow system and from which the recirculation system operates.

**TEMPERED WATER** is water between 100°F and 110°F.

**TURNOVER TIME** is the maximum time allowed to circulate one complete volume of the pool water through the recirculation system.

**UNIFORMITY COEFFICIENT** is the ratio of the theoretical size of a sieve in mm that will pass 60 percent of the sand to the theoretical size of a sieve in mm that will pass 10 percent of the sand.

**WADING POOL** is a pool intended to be used for wading by small children and having a maximum water depth of 18 inches (457 mm) at the deepest point.

**WATER FEATURE** means an interactive device or structure through which water is directed to the pool user such as a water fountain, water spray, dancing water jet, waterfall, dumping bucket or shooting water cannon.

**WATERLINE** shall be defined in one of the following:

1. **Skimmer system.** The waterline shall be the midpoint of the operating range of the skimmers.
2. **Overflow system.** The waterline shall be the top edge of the overflow rim.

## **PLAN REVIEW, PERMITS, CONSTRUCTION AND FIELD INSPECTIONS**

### **SECTION 3103B**

#### **PLAN REVIEW**

**3103B.1** A person proposing to construct, renovate or alter a pool, ancillary facilities or equipment and appurtenances shall submit plans and specifications detailing compliance with this chapter to the enforcing agent for review and written approval prior to commencing construction and shall first be cleared by the enforcing agent before substitution if not an exact duplicate of the units being changed or replaced. A local building department shall not issue a permit for a public pool or ancillary facility until the plans have been approved by the enforcing agent.

**3103B.2** Plans submitted for approval pursuant to this section shall be drawn to a scale of 1/4 inch (6.4 mm) equals 1 foot (305 mm), except that plans for spa pools shall be drawn to a scale of 1 inch (25 mm) equals 1 foot (305 mm), unless otherwise approved by the enforcing agent.

**3103B.3** The enforcing agent shall notify the person submitting the plans and specifications of approval or disapproval.

**3103B.4** The enforcing agent shall retain one copy of the approved plans and specifications and any subsequent changes or modifications. The approved plans shall be valid for a period of two years from the date of approval or as extended by the enforcing agent.

**SECTION 3104B CONSTRUCTION** Pools and all ancillary facilities, equipment and appurtenances shall be constructed, renovated or altered in compliance with plans approved pursuant to Section 3103B.

### **SECTION 3105B**

#### **PLAN COMPLIANCE INSPECTIONS**

**3105B.1** The pool owner, operator or designated agent shall notify the enforcing agent prior to scheduling the following inspections:

1. Exposed plumbing;
2. Prior to applying pneumatically placed concrete;
3. Prior to applying the final surface to the pool shell; and
4. At the completion of construction. No pool shall be opened to the public without the written approval of the enforcing agent.

### **SECTION 3107B**

#### **ALTERNATIVE EQUIPMENT, MATERIALS AND METHODS OF CONSTRUCTION**

**3107B.1** The enforcing agent may approve an alternative equipment, material or method of construction provided it finds that the proposed design is satisfactory and complies with the provisions of this chapter, that the equipment, material, method or work offered is, for the purpose intended, at least equivalent to that prescribed in suitability, strength, effectiveness, fire resistance, durability, safety and sanitation or that the methods of installation proposed conform to other acceptable nationally recognized standards.

### **SECTION 3108B**

## POOL CONSTRUCTION

**3108B.1 Pool shell.** The pool shall be built of reinforced concrete or material equivalent in strength, watertight and able to withstand anticipated stresses under both full and empty conditions taking into consideration factors such as climatic effects, geological conditions and integration of the pool with other structures.

**3108B.2 Finish.** The finished pool shell shall be lined with a smooth waterproof interior finish that will withstand repeated brushing, scrubbing, and cleaning procedures. The interior pool finish shall completely line the pool to the tile lines, coping, or cantilevered deck.

**3108B.3 Finish color.** The finish color shall be white except for the following which shall be of contrasting color: 1. Lane and other required pool markings described in Section 3110B; 2. The top surface edges of benches in spa pools; 3. The edge of pool steps; 4. Tiles installed at the waterline; and 5. Tiles installed at the 4 1/2-foot (1372 mm) depth line.

**Exception:** A spa pool may be finished in a light color other than white when approved by the enforcing agent.

## SECTION 3110B PERMANENT MARKINGS

**3110B.1 General.** No markings, designs or lettering shall be permitted on the pool shell except for slip resistant lane markings, depth marking lines and safety markings.

**3110B.3 Depth marking line.** There shall be installed a straight line of slip resistant tile a minimum of 4 inches (102 mm) and not greater than 6 inches (152 mm) wide of a color contrasting with the background of the pool shell across the bottom of the pool where the water depth is 4 1/2 feet (1372 mm).

**Exception:** Pools having a maximum water depth of 5 feet (1524 mm) or less shall not be required to have a depth marking line.

**3110B.4 Water depth markers. 3110B.4.1 Location.** The water depth shall be clearly marked at the following locations: 1. Maximum depth; 2. Minimum depth; 3. Each end; 4. Both sides at each end; 5. At the break in the bottom slope between the shallow and deep portions of the pool (see also Section 3109B.4); and 6. Along the perimeter of the pool at distances not to exceed 25 feet (7620 mm).

**Exception:** A spa or wading pool shall have a minimum of two depth markers indicating the maximum depth.

**3110B.4.2 Position.** Where required by Section 3110B.4.1, depth markers shall be located in the following positions: 1. On the coping or on the deck the depth markers shall be placed as close as possible but no more than 3 feet (914 mm) from the pool water; and 2. For pools with skimmer systems the depth markers shall be high at the waterline which typically will result in the depth markers being submerged approximately 50 percent; or 3. For pools with perimeter overflow systems where coping cantilevers over the gutter depth markers may be positioned at the face of the cantilevered coping, the back wall above the gutter or immediately below the waterline which will result in the depth markers being completely submerged; or 4. For pools with rim flow gutters depth markers shall be positioned immediately below the waterline which will result in the depth markers being completely submerged.

**3110B.4.3 Tolerance.** Depth markers shall be positioned to indicate the water depth accurate to the nearest 6 inches (152 mm) as measured at the waterline.

**3110B.4.4 Size of markers.** Depth markers shall: 1. Have numerals a minimum of 4 inches (102 mm) in height and of a color contrasting with the background and be marked in units of feet and inches.

Abbreviations of FT and IN may be used in lieu of feet and inches; and 2. Be made of a durable material that is resistant to weathering; and 3. Be slip resistant when they are located on the pool deck.

**3110B.5 No diving markers.** For pool water depths 6 feet (1830 mm) and shallower no diving markers with the universal symbol of no diving, which is a red circle with a slash through it superimposed over the image of a diver, shall be installed on the deck directly adjacent to the depth markers required by Section 3110B.4.1. No diving markers shall comply with Section 3110B.4.4(2-3).

## **SECTION 3115B POOL LIGHTING**

**3115B.1 General.** Pools shall have underwater and deck lighting such that lifeguards or other persons may observe, without interference from direct and reflected glare from the lighting sources, every part of the underwater area and pool surface, all diving boards or other pool appurtenances. If underwater or deck surface lighting is not operational, the operator of the pool shall secure the pool area and not permit any use of the pool after dark and shall post the same sign as required in Section 3120B.9.

**Note:** See Part 3, Article 3-680, Title 24, California Code of Regulations for electrical installation requirements

**3115B.2 Nighttime use.** Pools used at night shall be equipped with underwater lighting fixtures that will provide complete illumination to all underwater areas of the pool with no blind spots. Illumination shall enable a lifeguard or other persons to determine whether: 1. A pool user is lying on the bottom of the pool; and 2. The pool water conforms to the definition of "clear pool water."

**Exception:** Pools provided with a system of overhead lighting fixtures where it can be demonstrated to the enforcing agent that the system is equivalent to the underwater lighting fixture system.

**3115B.3 Deck area lighting.** When the pool is to be used at night, pool deck areas and emergency egress areas shall be provided with lighting so that persons walking on the deck can identify hazards. Lighting fixtures shall be aimed towards the deck area and away from the pool surface insofar as practical.

## **SECTION 3118B**

**HOSE BIBBS** Potable water outlets with hose attachments shall be protected by a nonremovable hose bibb backflow preventer, a nonremovable hose bibb vacuum breaker, or by an atmospheric vacuum breaker installed not less than 6 inches (152 mm) above the highest point of usage located on the discharge side of the last valve as required by the California Plumbing Code. In climates where freezing temperatures occur, a listed self-draining frost-proof hose bibb with an integral backflow preventer or vacuum breaker shall be used. Hose bibbs shall be provided so that all portions of the pool deck area may be reached with a 75 foot length of hose attached to the hose bibb. A hose bibb shall be provided in the equipment area. Hose bibbs shall be located so that they do not constitute a hazard.

## **SECTION 3120B REQUIRED SIGNS**

**3120B.1 General.** All signs shall have clearly legible letters or numbers not less than 4 inches (102 mm) high, unless otherwise required in this section, affixed to a wall, pole, gate or similar permanent structure in a location visible to all pool users.

**3120B.2 Pool user capacity sign.** A sign shall indicate the maximum number of pool users permitted for each pool.

**3120B.2.1 Spa pool.** The pool user capacity of a spa pool shall be based on one pool user for every 10 square feet (0.929 m<sup>2</sup>) of pool water surface area.

**3120B.2.2 Other pools.** The pool user capacity for all other pools shall be based on one pool user for every 20 square feet (1.858 m<sup>2</sup>) of pool water surface area.

**Exception:** Pool user capacity requirements do not apply to wading pools or spray grounds.

**3120B.3 No diving sign.** Signs shall be posted in conspicuous places and shall state, "NO DIVING" at pools with a maximum water depth of 6 feet or less.

**3120B.4 No lifeguard sign.** Where no lifeguard service is provided, a warning sign shall be posted stating, "WARNING:NO LIFEGUARD ON DUTY." The sign also shall state in letters at least 1 inch (25 mm) high, "Children under the age of 14 shall not use pool without a parent or adult guardian in attendance."

**3120B.5 Artificial respiration and CPR sign.** An illustrated diagram with text at least 1/4 inch (6 mm) high of artificial respiration and CPR procedures shall be posted.

**3120B.6 Emergency sign.** The emergency telephone number 911, the number of the nearest emergency services and the name and street address of the pool facility shall be posted.

**3120B.7 Warning sign for a spa pool.** A warning sign for spa pools shall be posted stating, "CAUTION" and shall include the following language in letters at least 1 inch (25 mm) high: 1. Elderly persons, pregnant women, infants and those with health conditions requiring medical care should consult with a physician before entering the spa. 2. Unsupervised use by children under the age of 14 is prohibited. 3. Hot water immersion while under the influence of alcohol, narcotics, drugs or medicines may lead to serious consequences and is not recommended. 4. Do not use alone. 5. Long exposure may result in hyperthermia, nausea, dizziness or fainting.

**3120B.8 Emergency shut off.** In letters at least one inch (25 mm) high a sign shall be posted at the spa emergency shut off switch stating, "EMERGENCY SHUT OFF SWITCH."

**3120B.9 No use after dark.** Where pools were constructed for which lighting was not required, a sign shall be posted at each pool entrance on the outside of the gate(s) stating, "NO USE OF POOL ALLOWED AFTER DARK."

**3120B.10 Keep closed.** A sign shall be posted on the exterior side of gates and doors leading into the pool enclosure area stating, "KEEP CLOSED."

**3120B.11 Diarrhea.** A sign in letters at least 1 inch (25 mm) high and in a language or diagram that is clearly stated shall be posted at the entrance area of a public pool which states that persons having currently active diarrhea or who have had active diarrhea within the previous 14 days shall not be allowed to enter the pool water.

**3120B.12 Wave pools.** A sign in letters at least 1 inch (25 mm) high shall be posted that describes the requirements for wave pools as described in Section 115952, Health and Safety Code.

**3120B.13 Spray ground sign.** A sign shall be posted at each spray ground and be visible from any part of the spray ground that states, "CAUTION: WATER IS RECIRCULATED. DO NOT DRINK."

**3120B.14 Exit.** Where automatic gaseous chlorine chemical feeders are used, a sign shall be posted at the pool area entrance which shows in a diagrammatic form an emergency evacuation procedure. Designated emergency exits shall be marked "EXIT."

**3120B.15 Gaseous oxidizer.** Where automatic gaseous chlorine chemical feeders are used, a warning sign with the appropriate hazard identification symbol shall be posted on the exterior side of the door

entering the chemical feeder room or area. The sign shall state, "DANGER: GASEOUSOXIDIZER - (specific chemical name)," or as otherwise required by the California Fire Code.

**3120B.16 Turn on before entering.** Where automatic gaseous chemical feeders are used, a sign shall be posted at the switch to the light and ventilation system for the gaseous chemical feeder room stating, "TURN ON BEFORE ENTERING," or as otherwise required by the California Fire Code or the California Electrical Code.

## **RECIRCULATION SYSTEM COMPONENTS**

### **SECTION 3123B**

#### **GENERAL REQUIREMENTS**

**3123B.1 System description.** Each pool shall be provided with a separate recirculation system designed for the continuous recirculation, filtration and disinfection of the pool water. The system shall consist of pumps, filters, chemical feeders, skimmers or perimeter overflow systems, valves, pipes, connections, fittings and appurtenances.

**Exception:** Pools using fresh water equivalent in flow to the requirements of Section 3124B.

**Note:** Fresh makeup pool water shall conform to the water quality standards of Section 65531, Chapter 20, Title 22, California Code of Regulations.

**3123B.2 Equipment.** All pumps, filters, chemical feeders, skimmers and supplemental equipment shall comply with the applicable requirements established by the NSF/ANSI 50-2010 performance standard effective August 2010.

**3123B.3 Installation.** All equipment related to pool operations shall be installed and maintained according to this chapter and in accordance with the equipment manufacturer's written instructions.

**3123B.4 Equipment access.** All filters, valves, pumps, strainers and equipment shall be readily accessible for repair and replacement.

### **SECTION 3124B**

**TURNOVER TIME** The recirculation system shall have the capacity to provide a complete turnover of pool water in: 1. One-half hour or less for a spa pool; 2. One-half hour or less for a spray ground; 3. One hour or less for a wading pool; 4. Two hours or less for a medical pool; and 5. Six hours or less for all other types of public pools. (Eight hours for swimming pools built before 1982)

**3125B.2 Gauges.** A pressure and vacuum gauge shall be provided for each pump system. Each gauge shall have a scale range approximately 1 1/4 times the maximum anticipated working pressure or vacuum and shall be accurate within 2 percent of scale.

**3125B.3 Flow meter.** A flow meter shall be provided on each recirculation system accurate to within 10 percent of flow and installed according to the manufacturer's written instructions with increments in the range of normal flow.

**3125B.4 Basket strainer.** A basket strainer shall be provided on the suction side of the recirculation pump. A basket strainer will not be required on pumps connected to vacuum filters where the filter elements are not removed for cleaning.

**3125B.5 Backwash piping.** Piping, including necessary valves conforming to Section 3125B.1, shall be provided for each filter vessel or element which requires periodic backwashing.

**3125B.6 Valves.** Valves shall not be located in any deck area surrounding a pool. Valves shall be installed on all recirculation, backwashing and drain system lines which require shutoff isolation,

adjustment or control of the rate of flow. Each valve shall be installed in the equipment area and labeled as to its purpose.

**3127B.2 Backflow prevention.** There shall be no direct connection between any potable water supply system and the pool or its piping system unless protected by a backflow prevention device accordance with Chapter 6 of the California Plumbing Code.

## **SECTION 3128B FILTERS (ALL TYPES)**

**3128B.1 General requirements.** All filters, regardless of type, shall be designed and constructed according to the applicable requirements established by the NSF/ANSI 50-2010 performance standard effective August 2010.

**3128B.2 Installation.** Each filter vessel shall be installed, piped and provided with valves so that it can be isolated from the recirculation system for repairs and backwashing.

**3128B.3 SECTION 3129B RAPID SAND PRESSURE FILTERS** In addition to the requirements for all filters as indicated in Section 3128B, the following apply to rapid sand pressure filters.

**3129B.1 Flow rates.** The filtration rate shall not exceed 3 gpm per square foot (122.24 L/m per m<sup>2</sup>) of filter area. The backwash rate shall not be less than 15 gpm per square foot ( 611.2 L/m per m<sup>2</sup>) of filter area.

## **SECTION 3130B**

**DIATOMACEOUS EARTH FILTERS** In addition to the requirements for all filters as indicated in Section 3128B, the following apply to diatomaceous earth filters.

**3130B.1 Flow rates.** The filtration rate for both pressure and vacuum diatomaceous earth filters shall not exceed 2 gpm per square foot (81.49 L/m per m<sup>2</sup>) of filter area.

## **SECTION 3131B**

**HIGH-RATE SAND FILTERS** In addition to the requirements for all filters as indicated in Section 3128B, the following apply to high rate sand filters.

**3131B.1 Flow rates.** Maximum and minimum flow rates for backwash and filtration shall be maintained according to the applicable requirements established by the NSF/ANSI 50-2010 performance standard effective August 2010.

## **SECTION 3132B**

**CARTRIDGE FILTERS** In addition to the requirements for all filters as indicated in Section 3128B, the following apply to cartridge filters.

**3132B.1** The filtration rate shall not exceed 0.375 gpm per square foot of filter area.

**3132B.2** An approved wash down area equipped with potable water shall be provided in the pool equipment area with permanently installed drainage piping discharging to the public sewer or wastewater system approved by the enforcing wastewater agency. The filter vessel shall be capable of being drained and shall be equipped with an indirect drain for the purpose of draining the entire contents of the filter vessel. Drainage and backwash piping shall be considered indirect waste and installed in accordance with the requirements of Chapter 8 of the California Plumbing Code.

**3132B.3** An additional set of filter elements shall be available for installation while the existing filter elements are cleaned.

**SECTION 3133B**

**CHEMICAL FEEDERS** All chemical feeders including disinfectant feeders and the auxiliary feeders used for solutions, slurries or solids, along with components such as pumps, strainers, tubing connections, tanks and injection fittings shall comply with the provisions of this section.

**3133B.1 General design requirements.** The chemical feeder equipment shall: 1. Be maintained and repaired according to manufacturers' specifications; 2. Be constructed with an adjustable output rate device to permit repeated adjustments without loss of output rate accuracy and adjusted by an automatic chemical monitoring and control system; and 3. Meet the applicable requirements established by the NSF/ANSI 50-2010 performance standard effective August 2010.

**3133B.3 Installation.** Chemical feeders and associated components shall be constructed and installed to prevent uncontrolled discharge or siphoning of chemicals and fumes directly into the pool, its recirculation system, the pool area or ancillary facilities.

**SECTION 3134B**

**DISINFECTANT FEEDERS** Disinfectant feeders shall comply with applicable requirements established by the NSF/ANSI 50-2010 performance standard effective August 2010 for disinfectant feeders. In addition to the requirements for chemical feeders as indicated in Section 3133B, the following apply to disinfectant feeders.

**3134B.1 Minimum capacity.** All feeders shall be capable of supplying not less than the equivalent of 3 pounds (1 kg) of 100 percent available chlorine per day per 10,000 gallons (37,850 L) of pool water capacity.

**3134B.2 Rate of flow adjustment.** A visible means of determining the rate of flow through the device shall be provided for each disinfectant feeder.

**3134B.3 Compressed chlorine gas disinfectant equipment.** Chlorine gas shall not be dispensed directly into the water of a pool except as an aqueous solution through the return line of the recirculation system.

**SECTION 3136B**

**POOL SKIMMING SYSTEMS** The pool shall be equipped with one or more skimming methods to provide continuous skimming of the pool water and shall be capable of continually withdrawing not less than 75 percent of the required flow rate.

**SECTION 3137B****POOL FITTINGS****SECTION 3138B****SPA POOL SPECIAL REQUIREMENTS**

**3138B.1 Aeration system.** A spa pool aeration and/or jet system shall be completely separate from the recirculation system and shall not be interconnected with any other pool.

**3138B.2 Maximum operating temperature.** The allowable water temperature of a spa pool shall not exceed 104° F (57.8° C).

**3138B.5 Emergency shut off switch.** A clearly labeled emergency shut off switch for the control of both the recirculation system and the aeration and/or jet system shall be installed adjacent to the spa pool.

## **3141B WASTEWATER DISPOSAL**

**3141B.1 General requirements.** Material cleaned from filters and backwash water from any recirculation system shall be disposed in a manner that is acceptable to the local wastewater agency and will not create a nuisance. Backwash water shall not be returned to a pool. Pipes carrying wastewater from pools including pool drainage and backwash from filters shall be installed as an indirect waste in accordance with the requirements of Chapter 8 of the California Plumbing Code. Where a pump is used to discharge waste pool water to the drainage system, the pump discharge shall be installed as an indirect waste.

**3141B.2 Diatomaceous earth filters.** The backwash from a diatomaceous earth filter shall discharge into a separation tank that has been installed to collect the waste diatomaceous earth mixture. The wastewater from the separation tank shall discharge into a sanitary sewer or other disposal system acceptable to the local wastewater agency.

**3141B.3 Piping.** Sumps and drain piping shall have sufficient capacity to receive recirculation system backwash without overflow of the sump receiver. The sump shall not permit sewage to enter the surge basin or the pool in the event of a sewage backup

**3141B.4 Visual indicator.** Where direct observation of the backwash discharge is not visible to the operator during backwash operations, a sight glass shall be installed on the wastewater discharge line.

**3141B.5 Prohibited connection.** There shall be no direct connection between the pool, its recirculation system or overflow drain to any sanitary sewer, storm drain or drainage system

**Part III**  
**Swimming Pool Inspection Report**

The following is a copy of a Swimming Pool Official Inspection Report which is left with the operator or owner of a pool when a pool inspection is made by the Health Department.

DATE VIOLATIONS CORRECTED		EHS INITIALS:		OPERATOR INITIALS:		<b>SWIMMING POOL OFFICIAL INSPECTION REPORT</b> COUNTY OF LOS ANGELES ♦ DEPARTMENT OF PUBLIC HEALTH ENVIRONMENTAL HEALTH																									
TIME OUT:		TIME IN:		INSPECTION DATE:		CITY:		SITE ADDRESS:		SITE NAME:		OWNER:		MAILING ADDRESS:		ZIP: <div>           CITY:           <div>STATE:</div> </div>		RECEIVED BY: <b>X</b>		EHS: (PRINT) EHS: (SIGNATURE)		THE MARKED ITEMS REPRESENT HEALTH CODE VIOLATIONS AND MUST BE CORRECTED See Reverse Side For The General Requirements That Correspond To Each Violation Listed Below									
																		<b>G</b> No Violations Observed at Time of Inspection		<b>G</b> Complaint Allegations Not Observed											
																		1		Life ring with attached rope		33		Drain cover - replace / secure							
																		2		Body hook attached to pole		34		Handrail(s) - repair / replace / secure / provide							
																		3		"No Lifeguard on Duty" sign		35		Ladder/Grab rail(s) – repair / replace / secure / provide							
																		4		Artificial respiration + CPR sign		36		Underwater light(s) – repair / secure in niche / provide							
																		5		Emergency information (911, address of pool)		37		Maintain underwater light(s) on when required							
																		6		Occupant capacity sign		38		Deck – deteriorating / uplifting / repair / fill expansion joint							
																		7		"Keep Closed" signs on outside of all exits		39		Pool enclosure – repair							
																		8		Diarrhea Warning sign		40		Pool enclosure - self-closing / self-latching gate/door							
																		9		Spa use precaution sign		41		Pool turnover - water recirculation							
																		10		"No Diving Allowed "sign		42		Recirculation system - operate when open							
																		11		Emergency shut-off sign for spa		43		Recirculation pump - repair / replace / approved							
																		12		Signs legible & clearly visible from pool deck		44		Filter - repair / replace / approved							
																		13		Free chlorine residual without stabilizer		45		Filter - backwash / service							
																		14		Free chlorine residual with stabilizer		46		Influent pressure gauge before the filter							
																		15		pH - not in an acceptable range		47		Vacuum gauge before the pump							
																		16		Cyanuric Acid (stabilizer)		48		Flowmeter - provide / repair / clean / replace							
																		17		Approved pool water test kit		49		Automatic chlorinator – provide / repair / replace / approved							
																		18		Pool water - cloudy / turbid / green		50		Automatic chlorinator – filled / operational							
																		19		Algae growth		51		No direct connection to sanitary sewer or drainage system							
																		20		Vacuum - brush pool - dirt / leaves / debris		52		Pool equipment room – clean							
																		21		Water line tile(s) - clean		53		Pool plaster deteriorating - repair / replaster							
																		22		Water line tile(s) - replace / provide		54		Restroom (toilets / urinals / lavatories - clean / repair)							
																		23		Depth marker tile(s) - replace / provide		55		Rest room- dispensers / towels / soap / toilet tissue							
																		24		Coping - repair / replace		56		Shower facilities - clean / repair							
																		25		Skimmer - adequate skimming / repair / replace		57		Showers - soap dispenser or containers / filled with soap							
																		26		Water level – raise / lower		58		Showers / lavatories – hot / cold water / temperature (110°)							
																		27		Skimmer strainer basket - replace / provide / clean</											

**SUMMARY OF THE CORRESPONDING LAWS AND REGULATIONS FOR THE VIOLATIONS LISTED ON THE FRONT SIDE OF THIS FORM.**  
**THIS SUMMARY PAGE LISTS THE GENERAL REQUIREMENTS FOR EACH ITEM. THE DEPARTMENT MAY CITE ADDITIONAL SECTIONS, AS NEEDED**

1. Every pool shall be equipped with a life ring having a minimum exterior diameter of 17 inches, readily accessible for use, with a  $\frac{3}{16}$ -inch rope attached, long enough to span the maximum width of the pool. Spas and wading pools are exempt. CCR, T22, Section 65539e.
2. Every pool shall be equipped with a rescue pole not less than 12 ft. in length with a body hook attached. Spas and wading pools are exempt. CCR, T22, Section 65539e.
3. Where no lifeguard service is provided, a warning sign shall be placed in plain view and shall state "WARNING- NO LIFEGUARD ON DUTY" with clearly legible letters at least 4 inches high. In addition, the sign shall also state "Children Under the Age of 14 Should Not Use Pool Without An Adult In Attendance." CCR, T24, Section 3120B.4.
4. At all pools, diagrammatic illustrations of artificial respiration and CPR procedures shall be posted where clearly visible from the pool deck. CCR, T24, Section 3120B.1.
5. An emergency telephone number "911", address of the nearest emergency services and address of the pool facility shall be posted. CCR, T24, Section 3120B.6.
6. A sign, with letters not less than 4 inches high, shall be posted which shall indicate the number of occupants permitted for each pool. Swimming pools = 1 per 20 sq.ft. of pool surface area. Spa pool = 1 per 10 sq.ft. CCR, T24, Section 3120B.2.
7. A sign shall be posted on the exterior side of all gates and doors leading into the pool enclosure area stating, "Keep Closed." CCR T24, Section 3120B.10.
8. In letters at least 1 in. high, post a sign that states that persons having currently active diarrhea or diarrhea within the previous 14 days shall not be allowed to enter the pool water. CCR T24, Section 3120B.11
9. A spa precaution sign shall be posted which shall contain the following language: "Caution: 1. Elderly persons, pregnant women, infants and those with health conditions requiring medical care should consult with a physician before entering a spa. 2. Unsupervised use by children under the age of 14 is prohibited. 3. Hot-water immersion while under the influence of alcohol, narcotics, drugs, or medicines may lead to serious consequences and is not recommended. 4. Do not use alone. 5. Long exposure may result in nausea, dizziness or fainting." CCR, T24, 3120B.7.
10. Signs with clearly legible letters not less than 4 inches high shall be posted on all pools that have a depth of 6 feet or less and state: "NO DIVING ALLOWED." CCR, T24, Section 3120B.3.
11. For all spa pools with an emergency shut-off switch, a clearly labeled sign stating "Emergency Shut-off Switch" shall be posted next to the switch. CCR, T24, 3120B.8.
12. All required signs must be legible and clearly visible from the pool deck. CCR, T24, 3120B.1.
13. For pools not using stabilized chlorine, a free chlorine residual of at least 1.0 ppm shall be maintained throughout the pool. CCR, T22, 65529a.
14. For pools using stabilized chlorine, a free chlorine residual of at least 1.5 ppm shall be maintained throughout the pool. CCR, T22, 65529a.
15. Pool water shall be maintained at a pH between 7.2 and 8.0. CCR, T22, 65529a.
16. If used, the cyanuric acid (stabilizer) concentration in any pool shall not exceed 100 ppm. CCR, T22, Section 65523b.
17. A test kit is required that can test for a free chlorine residual, shall have 4 color standards, and be accurate to plus or minus 0.1 ppm. CCR, T22, 65529b.
18. Pool water shall be maintained in a clean and clear condition so the main drain is clearly visible from all areas of the deck. CCR, T22, Section 65527.
19. All surfaces of the pool and deck, and pool water shall be kept free of slime and algae. CCR, T22, Section 65533a.
20. The bottom and sides of the pool shall be cleaned as often as necessary to be kept in a clean condition. CCR, T22, Section 65533a.
21. Water line tiles shall be maintained in a clean condition. CCR, T22, Section 65533a.
22. Water line tiles shall be maintained in good repair. CCR, T22, Section 65533a.
23. The water depth shall be clearly marked at the following locations: On both sides, at maximum depth, minimum depth and at the break in slope and on both ends. CCR, T24, Section 3110B.4.
24. Every pool shall be provided with handholds (perimeter overflow system, bull-nosed coping, or cantilevered decking) CCR, T24, Section 3112B.1.
25. The pool shall be equipped with one or more skimming methods capable of continually skimming at least 75% of the water. CCR, Title24, Section 3136B.
26. Skimmers, where provided, and water levels shall be maintained (at mid-point) to continuously remove surface debris. CCR, Title22, Section 65533a.
27. Each skimmer shall be provided with a removable and cleanable screen or basket. CCR, Title24, Section 3136B.
28. The skimmer weir shall automatically adjust to variations in the pool water level over a range of not less than 4 inches and be in good repair. CCR, Title24, Section 3136B.
29. The skimmer shall be provided with an air-lock protective device. CCR, Title 24, Section 3136B.
30. The maximum allowable water temperature in a spa shall be 104 ° F . CCR, Title 24, Section 3138B.2.
31. Animals are prohibited in the pool and pool area. CCR, Title22, Section 65533b.
32. Chlorine tablets are prohibited in skimmers or floating chlorinators. CHSC, Section 116050.
33. All suction drain covers/grates shall be approved, in good repair and removable only with tools. CCR T24, Section 3162.
34. A handrail shall be provided, extending from the deck to not less than a point above the top of the lowest step and with the upper railing surface not less than 28 nor more than 36 inches above the deck. CCR, Title24, Section 3111B.3.
35. A ladder or grab rails with steps in the wall shall be provided at the deep end in pools with a maximum depth of 4½ feet or more. CCR, Title24, Section 3111B.1.
36. Pools used at night shall be equipped with underwater light fixtures with a GFCI . Pools with underwater lights shall be maintained in good repair. CCR, Title 24, Section 3115B.
37. Underwater pool light(s) shall remain "on" during all times the pool is open for use after dark. (dusk to dawn for courtyard pools). CCR, T24, Section 3115B.
38. A minimum continuous slip-resistant and unobstructed 4 foot-wide deck area flush with the pool shall extend completely around the pool. CCR, T24, Section 3114.B.
39. All parts of the pool and related pool facilities, including the pool enclosure, shall be maintained in good repair. CCR, T22, Section 65535.
40. Gates and doors shall be equipped with self-closing and self-latching devices no lower than 42 in. and no greater than 44 in. from the deck or walkway. CCR, T24, Section 31119B..
41. The recirculation system shall have sufficient capacity to provide a complete turnover of pool water: ½ hour or less for spa pools; ½ hour or less for spray pools: 1 hour or less for wading pools; 2 hours or less for medical pools; 6 hours or less for swimming pools built after 1982 and 8 hours or less for swimming pools built in or before 1982. CCR, T24, Section 3124B.
42. The recirculation system shall be kept in operation whenever the pool is available for use, and at such additional times as may be necessary to maintain the water in the pool in a clear and disinfected condition. CCR, T22, Section 65525.
43. All parts of the pool and pool facilities, including the pump, shall be maintained in good repair. CCR, T22, Section 65535a.
44. All parts of the pool and all related pool facilities, including the filter, shall be maintained in good repair. CCR, T22, Section 65535a.
45. The variation in flow during a filtration cycle shall be such as to not reduce the flow below 65 percent of the rate required in Section 3124B.CCR, T22 Section 65525.
46. An influent pressure gauge shall be provided before the filter. CCR, T24, 3125B.2
47. A vacuum pressure gauge shall be provided before the pump. CCR, T24 Section 3125B.2.
48. A flow meter shall be provided for each recirculation system. CCR T24, Section 3125B.3.
49. All pools shall have an automatic chlorinator. CCR, T24, Section 3134B.1.
50. The disinfectant and chemical feeders shall be kept in operation whenever the pool is available for use. CCR, T22, Section 65525.
51. No direct connection of the pool or its recirculation system shall be permitted with a sanitary sewer, storm drain, or drainage system except through an approved air-gap. CCR, T24, Section 3141B.5.
52. All parts of the pool and related pool facilities (equipment room) shall be maintained in a clean condition and in good repair. CCR, T22, Section 65535a.
53. The pool shell shall be lined with a smooth white waterproof finish CCR, T24, Sec. 3108B.3.
54. Toilets, urinals, showers, lavatories, and other plumbing fixtures shall be maintained in a clean condition and in good repair. CCR, T22, 65535c, CCR, T22, Section 65551b.
55. Soap, paper towels or hot air blowers, and toilet tissue shall be provided in permanently installed dispensing devices in all restrooms. CCR, T22, Section 65551c.
56. Showers shall be maintained in a clean condition and in good repair. CCR, T22, 65535c.
57. Showers shall be provided with soap in permanent soap dispensers or containers. CCR, T22, Section 65551b.
58. Showers and lavatories shall be provided with hot and cold water. A means to limit the hot water to 110 ° F (43 ° C) maximum shall be provided. CCR, T24, Section 3116B.
59. All parts of the pool and related pool facilities, including dressing room facilities, shall be maintained clean and in good repair. CCR, T22, Section 65535a.
60. Any health officer may at all reasonable times enter all parts of the premises of a public swimming pool to make examination and investigation to determine the sanitary condition and determine whether there are violations of the Pool Code. CHSC, Section 116055.
61. Every pool shall be under the supervision of a person who is fully capable of, and shall assume responsibility for, compliance with all requirements relating to pool operation, maintenance and safety of bathers. CCR, T22, Section 65521. The person shall be certified with this Department to maintain swimming pools. LACC Title 11, Section 11.34.040.
62. The operator of each pool shall keep a daily record of information regarding operation, including readings of disinfectant residual, pH, and maintenance procedures. CCR, T22, Section 65523a.
63. Where lifeguard service is provided, the number of lifeguards shall be adequate to maintain continuous surveillance over the bathers. CCR, T22, Section 65539b.

## **Part IV**

The following are construction requirements for pool renovations and equipment changes

## PLAN SUBMITTAL

- Any person proposing to renovate, replaster, reconstruct or alter, a public pool or its ancillary facilities, mechanical equipment or related piping, shall submit legible plans and specifications to the County of Los Angeles, Department of Public Health for review and written approval prior to commencing the work and in advance of the issuance of any building, plumbing, or electrical permits. Anytime a pool is acid washed or drained for any reason the pool shall be reviewed to determine if needs to be upgraded to the current pool code as specified below.
- Persons making modifications to the pool shell or major modifications to the recirculation system should refer to plan approval requirements for new pools.
- At least two sets of plans are required. This Department will retain one copy of the plans. A plan approval fee is required. The fee will depend on the extent of the renovation.
- After the renovation is complete, at least one field inspection will be made to verify compliance with the plan approval.
- All equipment shall be installed per the manufacturer's written instructions.
- Pool plan approval does not authorize the violation of any law, ordinance, or regulation, and final approval is subject to field inspection and evaluation.
- Plan approvals are valid for a period of two years from the date of the stamp.

## SPECIFICATIONS

The following information is required for the plan approval:

1. Job Address - address, city, zip.
2. Name, mailing address and phone numbers of pool contractor and owner.
3. RENOVATIONS - If the pool is being renovated, replastered or drained for any reason provide:
  - a. A simple top view drawing showing the length and width of the pool.
  - b. Resurfacing material and color.
  - c. Depth marker depths and locations.
  - d. Show the location of the contrasting tile on the floor at the 4 ½ ft. water depth. (Pools with a maximum water depth of 5 feet or less do not require a tile line).
  - e. Ladder(s) at the deep end of the pool. (Pools with a maximum water depth of 4½ ft. or less are not required to have a ladder)
  - f. Show the handrail(s) over the stairs with the distance from each step tread and deck to the top of the handrail.
  - g. Coping detail if the pool coping is being replaced.
  - h. If there is an existing diving board, provide scaled top and side view dimensions of the pool.
4. EQUIPMENT CHANGE OR PLUMBING – If any equipment is being changed, provide:
  - a. Year the pool was built.
  - b. Volume of pool.
  - c. Make and model number of existing equipment and any new equipment that is being installed.  
(See approved pool equipment list)
  - d. Make and model of existing pump
  - e. Size of suction and return lines going and coming from the equipment room.
  - f. Plumbing material (PVC, copper etc.)
  - g. Any other information that pertains to the equipment installation.

## REQUIREMENTS

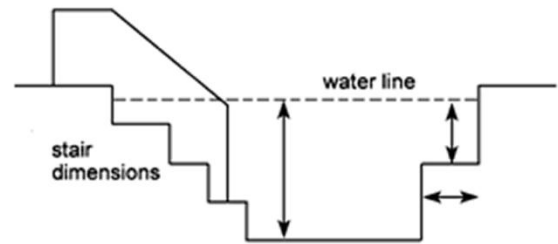
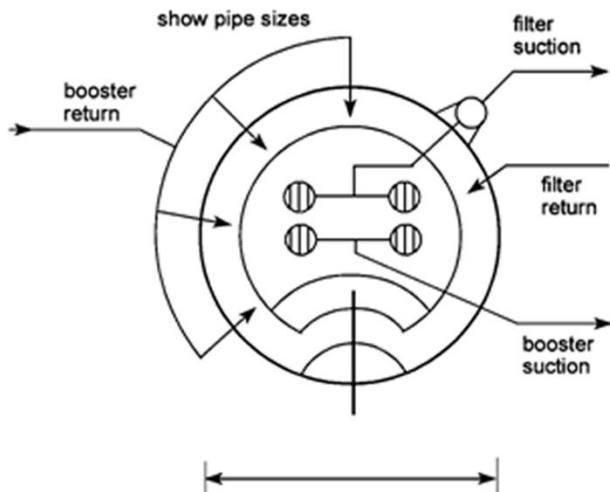
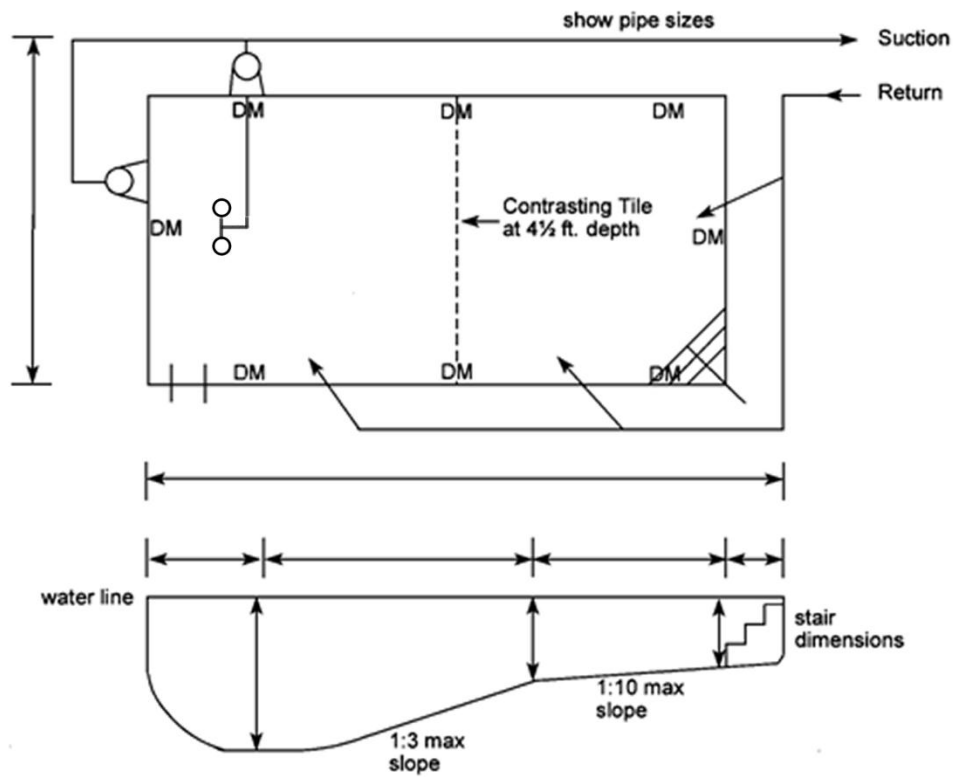
1. When a pool is renovated, certain items are required to be upgraded, depending on what changes are being made to the pool. At the end of each requirement below, in **bold**, it describes when the requirement applies.
2. *All pool equipment shall be listed in the Los Angeles County Approved Pool Equipment List.*
3. All swimming pools must be lined with white plaster or a smooth, waterproof, white interior finish, impervious to moisture and constructed of reinforced concrete or a material equivalent in strength and durability. If tile is used for the pool shell, the tile must be submitted to this Department for approval. There shall be no letters, marking or images of any kind other than safety markings on the pool shell. **Required when the pool is replastered or resurfaced.**
4. In pools greater than 5 ft. in depth, a straight line of slip-resistant tile of contrasting color must be installed where the water depth is 4½ ft. The tile must be at least 4 inches but not greater than 6 inches wide. **Required when the pool is replastered or resurfaced.**
5. Depth markers of contrasting color are required on both sides, at the minimum and maximum depths, at the break in slope and both ends of the pool. Markers must be permanent. Painted letters or stick-ons are not permitted. Depth markers must indicate the water depth, accurate to the nearest 6 inches as measured from the pool floor to the middle of the skimmer opening. The pool must be lined with ceramic waterline tiles around the entire perimeter of the pool.  
**Required when the pool is drained for any reason.**  
  
Depth markers are required on the deck at all locations corresponding the wall markers. **Required when the deck is replaced.**  
  
For pools with a maximum water depth of 6 ft. or less permanent no diving markers are required next to each of the deck depth markers. **Required when the deck is replaced.**  
  
All depth markers must be marked with the letters “feet” or “ft.” and “inches” or “in”.  
**Required when the depth markers are replaced.**  
  
Depth markers must be at least 4 inches in height. **Required when the depth markers are replaced.**
6. If contrasting tile is used along the edge of pool steps, it must be no greater than 4 inches wide and slip-resistant. **Required when the pool is replastered or resurfaced.**
7. A ladder as a second means of exit is required at the deep end of a pool having a water depth greater than 4½ ft. **Required when the pool drained for any reason.**
8. At least one hand rail is required for all stairs, except for a spa, two handrails are now required. The rail must be between 28 inches and 36 inches above the deck and above each step tread as measured from a flat portion of the deck and the edge of each step tread to the top of the handrail. The handrail must extend into the pool from the deck to the bottom step tread. There should be a minimum clearance of 3 inches between any handrail and step riser. (See handrail illustration at the end of the requirements). **Required when the pool is drained for any reason.**
9. All coping on pools must extend out into the pool at least one inch but not more than two inches. The coping must be at least 1 inches thick but no greater than 2½ inches thick. **Required when coping is replaced.**

10. Indoor/outdoor carpeting or similar products are not approved on the deck within four feet of a swimming or spa pool. Any deck material other than concrete must be approved by this Department. **Required when the deck is replaced.**
11. An influent pressure gauge placed before the filter but after the pump (usually found on top of the filter). An effluent pressure gauge is no longer required. **Required immediately.**
12. A vacuum gauge placed before the pump. **Required anytime a recirculation pump is replaced.**
13. A flowmeter must be installed on a horizontal straight run of pipe with a minimum of 10 pipe diameters before and 4 pipe diameters after the flowmeter. It should be positioned after the filter and before the heater. It may be installed after the heater, if a great enough distance can be maintained so that heated water will not damage the flowmeter. **Immediate requirement.**
14. An automatic chlorinator is required which is capable of supplying not less than the equivalent of 3 pounds of chlorine per day per 10,000 gallons pool water capacity. **Immediate requirement. For existing chlorinators sized at 2 lbs per 10,000 gallons per day, the 3 lb. per 10,000 gallons per day sizing is required whenever the chlorinator is replaced.**
15. No direct connection of a pool or its recirculating system shall be permitted with a sanitary sewer, storm drain or deck drain system. A sight glass is required when needed for observation of backwash water. **Immediate requirement.**
16. Each hose bibb at the site must be protected by an approved backflow device. **Immediate requirement.**
17. A life ring with rope attached is required (spas and wading pools exempt). **Immediate requirement.**
18. The rope must be as long as the, maximum width of the pool (spas, wading pools exempt). **Immediate requirement.**
19. For all changes in plumbing, suction drains, split drains, skimmer replacement, etc., refer to requirements for a new pool or a copy of the latest pool code. **Immediate requirement.**
20. All pools should already be in compliance with Title 24, Section 3162 of the California Building Code (Virginia Graeme Baker Safety Act).  
  
All suction drains on public pools must be split or have a safety vacuum release system or automatic pump shut-off system. **All drain covers must be correctly sized and listed on the Los Angeles County Approved Equipment List. For details, refer to requirements for a new pool or a copy of the latest pool code. Immediate requirement.**
21. All pool lights must be protected by a Ground Fault Circuit Interrupter. **Immediate requirement.**
22. All pools with diving boards will be evaluated during any plan check to assure it meets current pool code requirements. **Immediate requirement.**

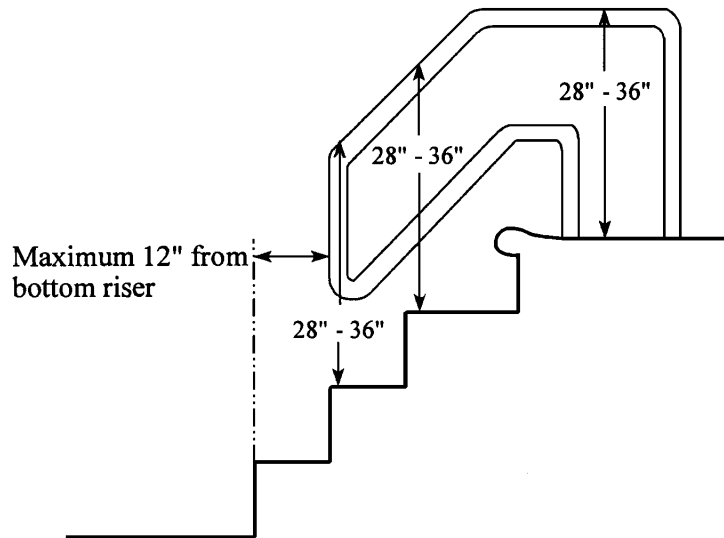
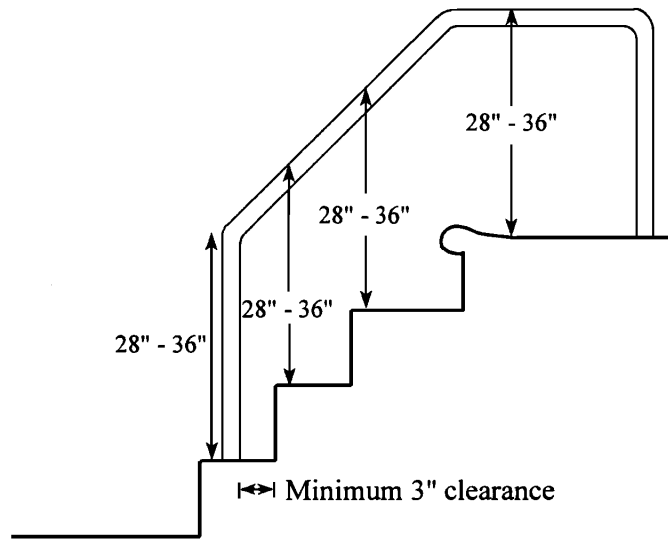
For more information, visit our web site at:

**[http://www.publichealth.lacounty.gov/eh/EP/rw/rw\\_plans.htm](http://www.publichealth.lacounty.gov/eh/EP/rw/rw_plans.htm)**

## DIAGRAMS AND SPECIFICATIONS



## APPROVED HANDRAIL CONFIGURATION



## RECOMMENDED LITERATURE

## 1. "Basic Training Manual, Part 1, Chemicals"

Independent Pool and Spa Service Association, Inc. (ipssa)  
10842 Noel Street #107  
Los Alamitos, CA 90720  
888-360-9505 email: [info@ipssa.com](mailto:info@ipssa.com) Internet: [www.ipssa.com](http://www.ipssa.com)

## 2. "Continuing Education Series, Pool Chlorination Facts"

Independent Pool and Spa Service Association, Inc. (ipssa)  
10842 Noel Street #107  
Los Alamitos, CA 90720  
888-360-9505 email: [info@ipssa.com](mailto:info@ipssa.com) Internet: [www.ipssa.com](http://www.ipssa.com)

3. "Everything You Always Wanted To Know About Pool Care"  
"Guide to Chlorine"  
"Guide to pH, Alkalinity, Water Testing and Water Balance"  
"Guide to Alternative Sanitizes"

Service Industry News  
P.O. Box 5829  
San Clemente, CA 92674-5829  
(949) 366-9981  
[www.poolspa.com/publications/sin/products.html](http://www.poolspa.com/publications/sin/products.html)

4. "Basic Pool and Spa Technology"  
various other publications

Association of Pool and Spa Professionals  
2111 Eisenhower Ave.  
Alexandria, VA 22314  
(703) 838-0083  
[www.apsp.org](http://www.apsp.org)

## 5. "Pool/Spa Operator's Handbook"

National Swimming Pool Foundation  
4775 Grandby Circle  
Colorado Springs, CO 80909  
For information, call (719) 540-9119  
or visit their web site at [www.nspf.com](http://www.nspf.com)

6. National Environmental Health Association  
720 S. Colorado Blvd.

Denver, CO 80246  
(303) 756-9090  
[www.neha.org](http://www.neha.org)

## RECOMMENDED POOL CLASSES

### ANTELOPE/SANTA CLARITA/SAN FERNANDO VALLEY

Blue Wave Certification Instruction  
Two Saturday classes  
Instructor: Tom Clark  
(661) 250-5316

### LOS ANGELES

Russ Tucker Pool School  
6 Saturday Morning Classes  
8:00 a.m. – 12:00 p.m.  
(310) 218-6693  
[www.russtuckerpools.com](http://www.russtuckerpools.com)

### Riverside / Anaheim / San Diego

2 day CPO classes  
Instructor: Steve Donohoe  
(949) 235-5888  
[www.AnotherPerfectPool.com](http://www.AnotherPerfectPool.com)

### SAN GABRIEL VALLEY

National Pool Tech Training  
222 E. Foothill Blvd.  
Monrovia, CA 91016  
Two day course  
(888) 609-0302  
(626) 303-3758  
[www.nationalpooltechtraining.com](http://www.nationalpooltechtraining.com)

### SAN FERNANDO VALLEY

Russ Tucker Pool School  
6 Friday Evening Classes  
5:00 p.m. – 9:00 p.m.  
(818) 998-7511  
[www.russtuckerpools.com](http://www.russtuckerpools.com)

### CERTIFIED POOL/SPA OPERATOR'S COURSE (CPO)

Offered at various times and locations throughout southern California  
National Swimming Pool Foundation  
4775 Grandby Circle  
Colorado Springs, CO 80909  
For information, call (719) 540-9119  
or visit their web site at [www.nspf.com](http://www.nspf.com)

**Part V****Practice Quiz**

The Los Angeles County Swimming Pool Service Technician Examination consists of 100 multiple choice questions.

Questions 1 - 90 are 1 point each.

Math questions 91 - 100 are 2 points each.

Total points 110.

The following is a practice quiz of 25 questions.

1. What effect does Sodium Hypochlorite have on the pH of pool water?
  - A. Raises
  - B. Lowers
  - C. Does not have any effect
  
2. Chloramines can cause
  - A. chlorine odor
  - B. eye burning
  - C. both A and B
  
3. A common name for Sodium Hypochlorite is
  - A. muriatic acid
  - B. conditioner
  - C. liquid chlorine
  
4. Calcium hardness should be kept between
  - A. 75 - 120 ppm
  - B. 150 - 300 ppm
  - C. 300 - 500 ppm
  
5. A Saturation Index of +0.9 indicates
  - A. etching conditions
  - B. balanced conditions
  - C. scaling conditions
  
6. Which chemical measures free chlorine
  - A. Orthotolidine (OTO)
  - B. Phenol Red
  - C. Diethyl-P-Phenylene Diamine (DPD)
  
7. What is the weight of one gallon of water?
  - A. 7.5 pounds
  - B. 8.3 pounds
  - C. 10 pounds

8. The filter that does the worst job at filtering small particles out of pool water is a
  - A. high rate sand filter
  - B. cartridge filter
  - C. diatomaceous earth filter
9. Turnover refers to
  - A. the number of bathers per day
  - B. pool volume recycles per day
  - C. length of time between backwashes
10. Water samples should be taken from
  - A. just below the surface
  - B. in front of the skimmer
  - C. 12" to 18" below the surface
11. How many gallons are contained in a cubic foot of water ?
  - A. 7.5
  - B. 8.3
  - C. 10
12. The minimum required turnover rate for a public swimming pool is
  - A. 6 hours
  - B. 8 hours
  - C. 12 hours
13. The influent pressure gauge is used to indicate
  - A. excessive air pressure
  - B. when to bleed off air
  - C. when to backwash the filter
14. Surge chambers are used to
  - A. skim the water surface
  - B. store filtered water

C. store displaced water

15. What is the legal required range of pH in a public pool
- A. 7.2 - 8.0
  - B. 7.4 - 7.6
  - C. 7.5 - 8.0
16. The main disinfecting agent when chlorine is added to water is
- A. Hypochlorous Acid
  - B. Hydrochloric Acid
  - C. Hypochlorite
17. Pools should be superchlorinated when chloramines exceed
- A. 0 ppm
  - B. .2 ppm
  - C. 1.0 ppm
18. The Pool Code requires that the chlorine residual in public pools be maintained above
- A. .2 ppm
  - B. .4 ppm
  - C. 1 ppm
19. Return lines in a pool recirculation system are those which
- A. return water to the pool
  - B. return water to the pump
  - C. supply water to the filter
20. The chemical name for Muriatic Acid is
- A. Hypochlorous Acid
  - B. Hydrochloric Acid
  - C. Sulfuric Acid
21. How many gallons are contained in a pool that is 40 feet long by 20 feet wide with an average depth of 4.5 feet?

- A. 18,000 gallons
  - B. 27,000 gallons
  - C. 32,000 gallons
22. A public swimming pool contains 30,000 gallons of water. What is the minimum size DE filter required by the State Pool Code?
- A. 42 sq.ft.
  - B. 72 sq.ft.
  - C. 166 sq.ft.
23. A DE filter contains three grid elements measuring 2 feet by 4 feet. What is the total surface area of the filter?
- A. 12 sq.ft.
  - B. 24 sq.ft.
  - C. 48 sq.ft.
24. If a pool is required to have a 6 hour turnover rate, what is the minimum required design flow rate for a 45,000 gallon pool.
- A. 100 gpm
  - B. 125 gpm
  - C. 140 gpm
25. The water in a 15' x 30' pool drops 2 feet. How many gallons have been lost?
- A. 6,750 gallons
  - B. 7,213 gallons
  - C. 8,122 gallons

#### Answers

- |       |       |       |
|-------|-------|-------|
| 1. A  | 11. A | 21. B |
| 2. C  | 12. A | 22. A |
| 3. C  | 13. C | 23. C |
| 4. B  | 14. C | 24. B |
| 5. C  | 15. A | 25. A |
| 6. C  | 16. A |       |
| 7. B  | 17. B |       |
| 8. B  | 18. C |       |
| 9. B  | 19. A |       |
| 10. C | 20. B |       |